



# **Henderson Inlet Watershed Fecal Coliform Bacteria, Dissolved Oxygen, and pH Total Maximum Daily Load**


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## **Water Quality Improvement Report Implementation Strategy**

**DRAFT**



July 2006  
Publication No. 06-10-058

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**Water Quality Improvement Report  
Implementation Strategy**

*by  
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**DRAFT**

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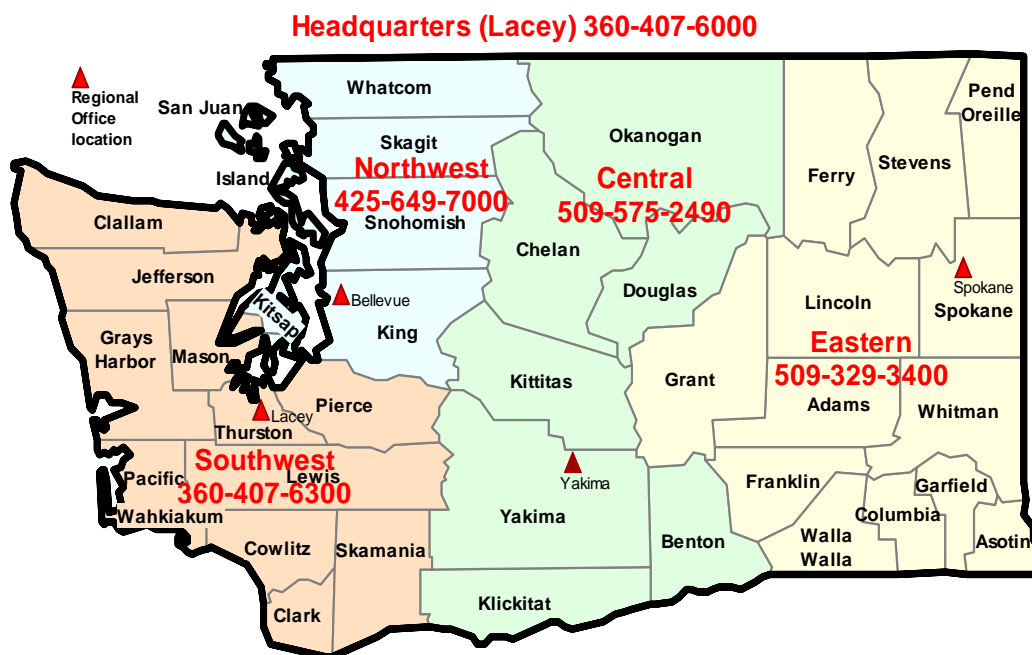
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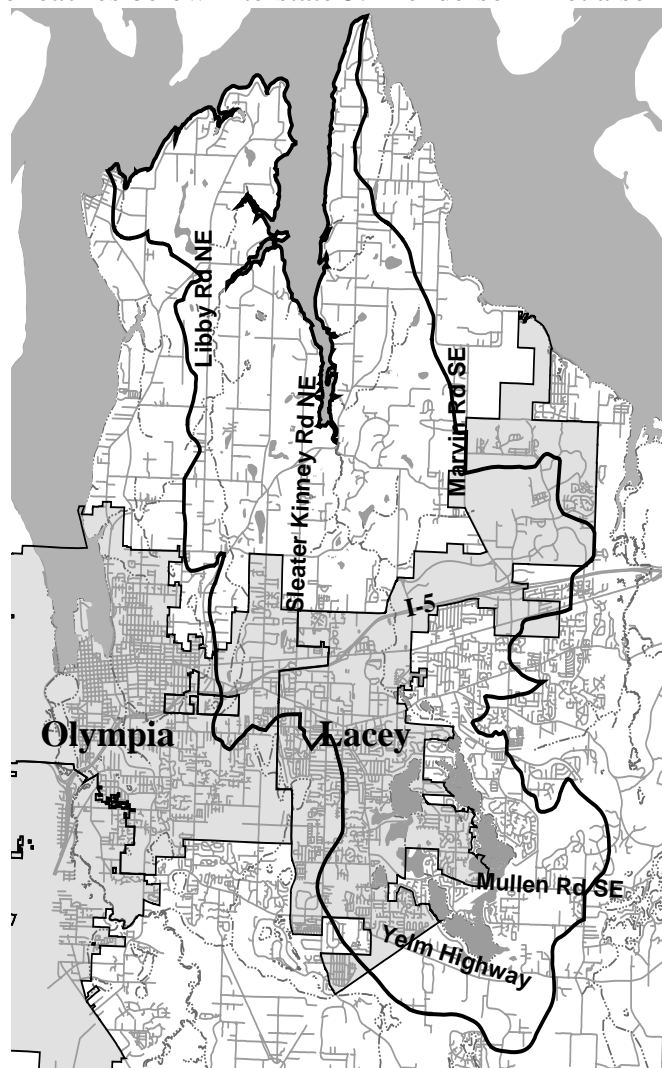
# Introduction

The Department of Ecology conducted a Total Maximum Daily Load (TMDL) water quality monitoring and modeling study in the Henderson Inlet watershed from 2002 to 2005. This study evaluated areas of the watershed with known or suspected water quality issues. Study results are presented in *Henderson Inlet Watershed Fecal Coliform Bacteria, Dissolved Oxygen, pH, and Temperature Total Maximum Daily Load Study*. You can review the entire report at <http://www.ecy.wa.gov/biblio/0603012.html>. The evaluation addressed fecal coliform bacteria, temperature, pH, and dissolved oxygen. It established TMDLs for fecal coliform bacteria.

Water bodies in the Henderson watershed support a variety of aesthetic, recreational, commercial, and educational opportunities. Freshwater areas provide habitat for aquatic organisms, including salmon, especially in the reaches below Interstate 5. Henderson Inlet also supports a variety of aquatic life, substantial commercial and recreational shellfish harvest, and recreational use. Ecology is conducting a TMDL in this watershed to reduce potential health risks to people who play and fish in the water or consume shellfish harvested from the water; to restore and sustain economic interests based on shellfish harvest; and to restore and protect habitat for aquatic life.

The waters of the Henderson Inlet watershed fall primarily under the jurisdiction of Thurston County and the city of Lacey. In addition, a little less than half of the Woodard Creek drainage, and a very small part of the Woodland Creek drainage, are either within the city of Olympia or its urban growth area. Land use is a mix of small farms, rural residential, and urban.

All three local governments are actively involved in water quality protection and improvement. The Squaxin Tribe is also involved in water quality efforts in this area, as are a number of other entities. There is a high level of commitment to, and interest in, protecting the water quality of this area and much work is underway.



**Figure 1: Henderson Inlet watershed (white areas are Thurston County jurisdiction)**

This support for maintaining water quality is vital to maintaining the quality and function of the watershed. Involved groups, their roles, responsibilities, and current water quality programs, are described below in the section entitled *Who needs to participate?*

There are also challenges to achieving water quality standards. Every major watershed in Thurston County is currently involved in a TMDL process (Henderson, Nisqually, Chehalis, Deschutes, and Tributaries to Totten and Eld Inlets). This work load creates a challenging demand on local resources. In addition, according to Thurston Regional Planning Council, Profile 2004

(<http://www.trpc.org/programs/estimates+and+forecasts/demographics/the+profile.htm>),

Thurston County experienced 29 percent growth overall between 1990 and 2000, and the city of Lacey urban area grew at an average annual rate of 2.5 percent. The current county population of 224,100 is projected to increase to 334,260 by 2025. More people means more houses, more impervious surfaces, more on-site septic systems, more pet waste, more lawn products, and so on.

Water availability is also an issue in some areas of the watershed. Although water supply is specifically addressed through processes other than TMDLs, the connection between water quantity and water quality is significant.

This Implementation Strategy is intended to describe the framework for improving water quality. It describes the roles and authorities of cleanup partners (i.e., those organizations with jurisdiction, authority, or direct responsibility for cleanup) and the programs or other means through which they will address these water quality issues.

Following U.S. Environmental Protection Agency (EPA) approval of this TMDL, interested and responsible parties will work together to develop a detailed *Water Quality Implementation Plan*. That plan will describe and prioritize specific actions needed to improve water quality, and it will guide and help coordinate the water quality improvement efforts. The recommendations and issues discussed in the following section will be primary considerations in that planning process.

# What Needs to be Done?

Much of the pollution in this watershed comes from many small sources – yards, on-site septic systems, runoff from fields, dog waste along the roadside, and other human-related sources. The discussion below is largely focused on these “nonpoint” sources.

There are also “point sources,” meaning discharges associated with a specific source, and regulated under NPDES (National Pollution Discharge Elimination System) permits. These point sources are Nisqually Trout Farm #2, which can be a source of biological oxygen demand, and various stormwater discharges that are regulated under the stormwater municipal NPDES Phase II permit. These stormwater discharges are under the jurisdiction of the WA Department of Transportation, Thurston County, and the cities of Lacey and Olympia.

Protecting and improving water quality is an on-going effort in this area. A number of the actions discussed in this section are already underway. Highlights of work in progress are noted in the *Reasonable Assurances* section.

## *Fecal coliform bacteria*

Efforts to reduce bacteria in the Henderson watershed will be based on the TMDL findings and recommendations, on the Shellfish Protection District citizens advisory group *Implementation Work Plan* (see page 15), and on local knowledge and priorities.

The following table is a partial look at reductions needed in the watershed to meet load and wasteload allocations. Please reference *Henderson Inlet Watershed Fecal Coliform Bacteria, Dissolved Oxygen, pH, and Temperature Total Maximum Daily Load Study* for complete information. The Fecal Coliform Loading Capacity section begins on page 70.

**Table 2. Summary of fecal coliform bacteria load and wasteload allocations for Henderson Inlet.**

Location	Class	Critical Period*	Fecal Coliform reduction needed	Target Capacity		Allocation type
				Limiting Criterion	Target Value (#/100 mL)	
Woodland Creek and tributaries						
Stormwater discharge at Woodland Cr RM 3.7	Freshwater Extraordinary Primary Contact	Storm event	99%	90 <sup>th</sup> percentile	100	Wasteload (Stormwater)
College Creek at RM 0.4	"	Storm event	86%	"	100	Wasteload (Stormwater)
WSDOT Stormwater discharge at Woodland Cr RM 3.1	"	Storm event	84%	"	100	Wasteload (Stormwater)
Stormwater discharge (I-5) at Woodland Cr RM 3.1	"	Storm event	91%	Geometric mean	50	Wasteload (Stormwater)
Stormwater discharge at Woodland Cr RM 2.6	"	Storm event	95%	90 <sup>th</sup> percentile	100	Wasteload (Stormwater)

Location	Class	Critical Period*	Fecal Coliform reduction needed	Target Capacity		Allocation type
				Limiting Criterion	Target Value (#/100 mL)	
Palm Creek	"	Storm event	59%	"	100	Load
Fox Creek	"	Storm event	78%	"	100	Load
Quail Creek	"	Storm event	96%	"	100	Load
Woodland Creek at RM 0.2	Marine Extraordinary	Storm event	92%	"	43	Load
Woodland Creek at RM 2.6	Freshwater Extraordinary Primary contact	Dry	43%	Geometric mean	50	Load
Eagle Creek	"	Dry	95%	90 <sup>th</sup> percentile	100	Load
Jorgenson Creek	"	Dry	89%	"	100	Load
Woodland Creek at RM 0.2	Marine Extraordinary	Dry	93%	Geometric mean	14	Load
Woodard Creek						
Stormwater discharge to Taylor wetland	Extraordinary Primary Contact	Storm event	98%	90 <sup>th</sup> percentile	100	Wasteload (Stormwater)
Woodard Creek at RM 6.9	"	Storm event	76%	"	100	Load
Woodard Creek at RM 0.0	Marine Extraordinary	Storm event	90%	"	43	Load
Henderson Inlet Tributaries						
Meyer Creek	Extraordinary Primary Contact	Storm event	87%	90 <sup>th</sup> percentile	100	Load
Sleepy Creek	"	Storm event	88%	"	100	Load
Dobbs Creek	"	Storm event	96%	"	100	Load
Goose Creek	"	Storm event	87%	"	100	Load

\* Dry season is June-September

Wet season is November-March

Storm-event period is storm events during November-March

The shellfish protection district's citizen advisory group was formed in response to commercial shellfish harvest restrictions in Henderson Inlet and Nisqually Reach. Their *Shellfish Protection Districts Implementation Work Plan* recommends long-term strategies necessary to protect shellfish harvest in Henderson Inlet.

The Henderson Inlet shellfish citizen advisory group's recommendations are specifically focused on reducing bacteria contamination in Henderson Inlet. The TMDL study is concerned with reducing bacteria throughout the watershed. These two evaluation and planning processes identified very similar needs. They include:

- Septic systems

Much of Henderson watershed is on septic systems. In a 1999-2001 bacteriological source identification study, Thurston County found human as the source type most frequently present in samples from Woodland Creek, and the second most frequent in marine water (Samadpour, Hofstad, Davis, 2002). Failed, failing, or poorly maintained septic systems, can create localized health hazards and contribute bacteria to water ways.

In fall 2005, Thurston County Board of Health took a critical step in protecting Henderson Inlet from bacteria pollution. They adopted a Septic System Operations and Maintenance Program for areas of Henderson watershed that drain to Henderson Inlet. This risk-based program will assure that homeowners properly maintain septic systems with a potential to affect water quality in Henderson Inlet.

Other strategies for reducing bacteria from septic systems include outreach to homeowners, availability of low interest loans to help homeowners who need to repair or replace their tanks, sewerage of appropriate areas, and additional investigation to identify sources and source areas.

Specific recommendations for bacteria reduction in the Henderson Watershed TMDL Study include:

- ~ Mandatory septic system operation and maintenance inspections throughout the watershed on a regular basis, with emphasis on systems located along shorelines and waterways. (This recommendation has been largely addressed by Thurston County's new Septic System Operation and Maintenance Program).
- ~ Strongly consider sewerage Woodland Creek Estates. (Note: septic system concerns in Tanglewilde are addressed in recommendations below for Stormwater.)
- ~ Investigate septic system sources: Jorgenson Creek, especially upstream from Pleasant Glade Road; on Woodard Creek between river miles 6.2 and 3.4; upland septic sources adjacent to Sleepy Creek; the RV facility on Dobbs Creek; along the Henderson Inlet shoreline.
- ~ In the Woodard Creek basin, leaking sewer lines and homeless campers are also potential sources.

- Stormwater

Stormwater is a major conveyor of bacteria. It picks up waste from yards, roads, roadsides, and parking lots. It carries waste from many sources, including pets, livestock, wildlife, and surfacing septage.

Physical treatment of stormwater for bacteria will be considered in the Water Quality

Improvement Plan, and in some high priority places is already underway (see *Reasonable Assurances*). Treatment of stormwater is difficult, expensive and, in many situations, of limited effectiveness. However, sources of polluted stormwater can be largely controlled through:

- ~ Improved development practices, particularly low-impact development practices that minimize or eliminate runoff.
- ~ Public outreach such as ongoing local programs to reduce pet waste, work with communities on maintaining their stormwater ponds, and public involvement in water quality and benthic invertebrate monitoring, and riparian restoration projects such as those provided by South Sound GREEN and Stream Team.
- ~ Wise local zoning and ordinances.

Washington Department of Transportation (WSDOT), Thurston County, and the cities of Lacey and Olympia are covered by stormwater municipal NPDES (National Pollution Discharge Elimination System) permits. Stormwater discharges within the permitted area, roughly half of Henderson watershed, are subject to permit requirements. Recommendations for appropriate best management practices will be developed as part of detailed planning.

Thurston County currently has TMDL projects in every major watershed. When evaluating and prioritizing their stormwater activities, the technical advisory group will work on a county-wide basis, not just within Henderson watershed.

Primary recommendations for managing stormwater sources of bacteria in the Henderson Watershed TMDL Study include:

- ~ Investigation and treatment of septic system sources in Tanglewilde to address the Martin Way discharge, which is the highest priority for source control in the Woodland Creek basin.
- ~ Working with neighborhoods adjacent to College Creek between river mile 0.6 and 0.3 to address septic system and pet waste sources, and evaluating treatment options for stormwater discharge to College Creek.
- ~ Updating WSDOT stormwater facilities at Interstate 5.



**Figure 2: College Creek**

- ~ Monitoring stormwater discharge to Taylor wetland (headwaters of Woodard Creek) regularly between December and March to determine treatment effectiveness. Stormwater discharge to this facility is a high priority for source control.
- ~ Investigating possible storm-event sources from stormwater facilities between Woodland Creek river mile 1.0 and 0.2.

Source reduction and more investigation are also recommended in other areas.

- Agriculture

While there are no major agricultural operations in the Henderson watershed, there are a number of small farms. Outreach and technical assistance to watershed residents will help raise awareness that healthy riparian areas, animals fenced from creeks, proper waste storage, good pasture management, application of fertilizers at agronomic rates (i.e., applying only what growing plants can take up) and other best management practices are important to protecting water quality. Landowners who keep livestock will be encouraged to work with the Thurston Conservation District to develop and implement a Conservation Plan.

Specific recommendations for managing agricultural sources of bacteria in the Henderson Watershed TMDL Study include:

- ~ Controlling domestic animal access to Eagle Creek, especially during the dry period.
- ~ Investigating domestic animal access on Sleepy Creek.
- ~ Investigating possible sources from the horse boarding facility on Dobbs Creek, and referral to the Conservation District if necessary.
- ~ Controlling domestic animal access to Meyer Creek and wetland.

- Land use

Recommendations in the *Henderson Inlet and Nisqually Reach Shellfish Protection Districts Implementation Work Plan* focus on:

- ~ Low Impact Development (LID) standards
- ~ Protective rezoning where appropriate
- ~ More protective development standards in some situations
- ~ Continuing the program to purchase land and build stormwater facilities to new standards as opportunity arises
- ~ Purchase of development rights and conservation easements for sensitive locations

- ~ Increased enforcement of current land use regulations
- ~ Outreach to stream and marine shoreline owners regarding the function and value of healthy riparian areas

These actions can be very effective in controlling the sources of bacteria pollution and reducing the need for expensive stormwater facilities.

- Wildlife

Wildlife contributes to bacteria concentrations. However, actions to improve water quality will focus on controllable, human-related causes. The technical advisory group that will oversee implementation will look for opportunities to influence human practices that may contribute to contamination from wildlife concentrations, for instance, in garbage collection areas that may attract rodents or birds.

- Additional investigation

Additional monitoring and investigation will be needed both to identify sources and source areas, and to monitor effectiveness of actions that are implemented. Some specific needs are noted above. Monitoring will also be needed to evaluate progress and, ultimately, to prove compliance with water quality standards.

Additional, focused studies may also be needed, such as the current Thurston County/City of Lacey project to evaluate pollutant loads into Woodland Creek between mile 3.8 and 1.6, or an additional microbial source tracking study.

### ***Dissolved oxygen and nutrients***

The Henderson Watershed TMDL study determined that low dissolved oxygen levels are from natural causes at river mile 3.45 in Woodland Creek (in the area of several groundwater discharges), in Meyer Creek, and Sleepy Creek. In other areas it appears to be human-related causes. While Washington State does not have water quality standards for nutrients (nitrogen and phosphorus), an overabundance of nutrients is a primary cause of low dissolved oxygen.

Addition of excessive nitrogen to marine systems like Henderson Inlet can cause too much algal growth which, in turn, can create low dissolved oxygen levels. The TMDL study found that Woodland Creek and some inputs to the creek - especially the stormwater discharge at river mile 3.7T (tributary), and the Woodland Creek Estates area - had some of the highest nitrate+nitrite concentrations of any creeks that discharge to Henderson Inlet. In addition, total nitrogen and nitrate+nitrite values for Woodland Creek tended to be on the high end of values typical for this region, as per EPA guidance (EPA, 2000).

Marine sampling for the Henderson Inlet watershed TMDL was not adequate to address the effects of nitrogen on the low dissolved oxygen levels that have been documented in Henderson Inlet. However, since values are relatively high, the TMDL study recommends, as a precaution, reduction of nitrogen sources to Woodland Creek.



Low dissolved oxygen levels in Woodard Creek are largely due to natural causes, as the creek originates in Taylor wetlands, and oxygen levels improve downstream. However, phosphorus is the limiting nutrient in Woodard Creek, and control of phosphorus sources to the creek could protect and possibly improve dissolved oxygen levels downstream of river mile 5.1.

Sources of nutrients in Henderson watershed include septic systems, manure (from livestock, pets, and wildlife), and over-application of fertilizers to yards and crop areas. Stormwater carries both nitrogen and phosphorus to streams and the inlet. In addition, nitrogen moves easily through the soil and enters water that moves beneath the ground (groundwater) and can eventually enter streams or marine waters.



**Figure 3: Fox Creek wetlands**

Many of the control methods cited above for bacteria will help reduce nitrogen. Additional investigation of potential human-related sources and possible widespread changes in groundwater nitrate concentrations in the Woodland Creek basin are also recommended. Specific recommendations in the *Henderson Watershed TMDL Study* for reducing nutrients and thereby improving oxygen levels include:

- Converting septic systems to sewer in areas of high residential density within the Urban Growth Area.
- Investigating possible widespread changes in groundwater nitrate concentrations in the Woodland Creek basin.
- Investigating possible human-caused sources of nitrogen to groundwater, including inputs from on-site sewage systems and fertilizer use.
- Applying fertilizers at agronomic rates (i.e., only what plants can readily use), with a no-application buffer zone adjacent to waterways (farmers *and* homeowners).
- Implementing effective shade recommendations on Woodland Creek
- Setting biochemical oxygen demand limits as a wasteload allocation for Nisqually Fish Farm #2
- Treating stormwater discharges to Woodland Creek to reduce or remove nutrients.
- Continuing to monitor ammonia, nitrogen, and total nitrogen in Woodland Creek on a regular basis to quantify trends over time.

- While low dissolved oxygen levels in Woodard Creek from river mile 5.1 to 2.9 are largely due to natural causes, controlling sources of phosphorus to the creek is recommended to protect the creek from further oxygen depletion, and to possibly improve oxygen levels in this reach and downstream.
- Additional investigation is recommended of possible sources along Fox Creek.
- Periodically reviewing the operation and planned expansion of the Hawks Prairie Water Reclamation Facility, including any on-site and off-site monitoring conducted by the LOTT Alliance or its consultants.
- Continuing to monitor dissolved oxygen levels in Henderson Inlet, particularly profiles during fall conditions.
- Developing a model of Henderson Inlet (as part of a future South Puget Sound marine study) to evaluate the relative influence of factors contributing to low dissolved oxygen levels in the marine areas, and determine load and wasteload allocations such that the inlet meets water quality standards in the future.

## *pH*

Occasional excursions of pH in several of the creeks are considered natural, due to acidic wetland and coniferous forest soils, and systems driven at times by heavy rainfall.

## *Temperature*

The report does not address the temperature listing in the upper portion of Woodland Creek (i.e., upstream of Beatty Springs). However, the report notes that full site potential shade alone is predicted to be insufficient to meet state water quality standards for temperature. This reach of the creek experiences low and no flow conditions during much of the year, as well as receiving flow from a series of lakes that can become very warm in summer. Additional analysis is needed in order to establish background conditions from Long Lake to Beatty Springs, and to develop load and wasteload allocations.

From Beatty Springs to the mouth, Woodland Creek meets water quality standards. The report does make recommendations for shade in order to continue meeting water quality standards in the future. In addition, the report:

- Establishes a wasteload allocation for the Nisqually Trout Farm #2 of a discharge temperature that does not cause the receiving water temperature to rise greater than an increment of 1.2<sup>0</sup> C or above a maximum temperature of 15.2<sup>0</sup>C at any time. Under current operating practices of the Trout Farm, there appears to be no reasonable potential for the current operation to cause or contribute to violation of the water quality standards, or to exceed 15.2<sup>0</sup>C.
- Establishes a wasteload allocation for stormwater sources based on the current water quality standards for Class AA freshwater systems. The allocation applies to all current

and future stormwater sources that enter this section of the creek, and only to stormwater discharges that may occur during the critical summer low-flow period. The wasteload allocation will be expressed in terms of approved best management practices and adaptive management.

To help prevent degradation of Woodland Creek between Beatty Springs and Henderson Inlet, the report also recommends:

- Watershed residents should continue to be encouraged to use water wisely.
- The city of Lacey and Thurston County should continue to carefully manage storm runoff from impervious surfaces in accordance with the minimum requirements and technical guidance provided by the Stormwater Management Manual of Western Washington.
- Measures should be taken to protect springs and tributaries in lower Woodland Creek from further degradation, including measures to protect riparian vegetation and groundwater in hydraulic continuity.
- Practice Low Impact Development principles for new development where applicable and supported by science.



- If alternative water sources are available, it is preferable to avoid drilling new exempt wells within the Woodland Creek basin. The city of Lacey is currently considering the possibility of prohibiting new exempt wells within Lacey city limits.

Elevated temperatures in other areas are considered natural.

**Figure 4: Woodland Creek near the mouth**

### ***Enforcement***

Many resources are available to help landowners improve practices which are contributing to the problems identified in the TMDL study. The intention is to encourage and support voluntary efforts. However, if needed, Thurston County, the cities of Lacey and Olympia, and Ecology have enforcement authority.

## Who Needs to Participate?

The following key organizations have responsibilities or authorities in this coordinated cleanup effort. Following Environmental Protection Agency approval of the Nisqually TMDL, the technical advisory group, which included the groups described below, will develop and implement a detailed Water Quality Improvement Plan. Ecology will coordinate that effort, expected to begin in fall, 2006.

### *City of Lacey*

The city of Lacey's population in 2005 was 33,180. Residential waste disposal within the city is a mix of on-site septic systems and sewer connections to LOTT wastewater treatment facilities. Thurston County has jurisdiction over on-site septic systems, both within and outside city limits. Lacey operates the wastewater utility for sewer conveyance to LOTT facilities.

Lacey has development standards that apply to new developments within city limits. In the Urban Growth Area (UGA), development must adhere to city development standards for water and sewer if the development is to be connected to the city's systems. Thurston County has jurisdiction over all other development in the UGA, including stormwater management, but takes comments from city staff who review the development plans. However, the county has final authority in unincorporated areas. The county and Lacey are currently partnering on a grant project to investigate the groundwater and surface water impacts of on-site septic systems and stormwater in two geographic areas within the Woodland Creek basin.

Title 14, Chapter 33 of the Lacey municipal code establishes 200' buffers for Woodland Creek within Lacey city limits. New development within Lacey must meet specifications of the 2005 Lacey Stormwater Manual. In addition, Title 14, Chapter 3 (Zero Effect Drainage Discharge) of the municipal code allows for Low Impact Development within the city limits. Lacey is also participating in a region-wide effort to develop low impact development standards and guidelines.

Lacey will be covered by the stormwater municipal NPDES Phase II permit, which Ecology expects to issue in late 2006. The majority of Lacey's stormwater drains to the Woodland Creek basin. College Ditch conveys the last untreated stormwater discharge in Lacey that flows directly into Woodland Creek. Design is currently underway to construct a regional treatment facility to address this outfall. Construction is anticipated for 2006.

Lacey conducts a number of stormwater-related outreach programs. They have a storm pond education program and a stormwater facility inspection program for privately-owned stormwater facilities. Lacey's Stream Team volunteer program includes storm drain stenciling and other pollution prevention education. They are also part of the region-wide pet waste pollution prevention program, which includes brochures, signage, and pet waste stations that are offered to homeowners associations and placed at city-owned facilities.

Lacey has conducted ongoing work to protect and restore the riparian buffer of Woodland Creek. They have "Plant Grants" available for creek side private property owners who want to establish native, riparian buffers. The grants include helping the landowner develop a planting

plan, help with labor, and providing plants up to a certain cost. Lacey is also working to plant public land along the creek. Woodland Creek Community Park has been a focus of this effort, where repeated replantings have been challenged by poor soils, vandalism, and wildlife. Lacey has also purchased a new site near Draham Road, where they are working to reestablish the buffer.

Lacey's ambient monitoring program, ongoing since 2000, provides data for baseline and trend analysis. They monitor monthly at Woodland Creek at Draham Road, Eagle Creek, and, when flow conditions allow, Woodland Creek at Martin Way and at the outlet of Lake Lois. Measurements include flow, temperature, pH, dissolved oxygen, conductivity, fecal coliform bacteria, and nitrate-nitrogen. Temperature is monitored on Woodland Creek at the Community Park. They completed a habitat assessment of Woodland Creek in 2003, as part of the effort to improve creek conditions for the salmon run. For the last four years they have conducted observational flow monitoring on the stretch of Woodland Creek between Lake Lois and the springs below Martin Way; this monitoring will continue. The Lacey Stream Team conducts benthic macroinvertebrate monitoring annually at four sites: Woodland Creek at Draham Road, Woodland Creek at Pleasant Glade Road, Fox Creek and Palm Creek. This data is included in Regional Water Quality Reports produced by Thurston County Environmental Health Division.

### ***City of Olympia***

The city of Olympia's Storm and Surface Water Utility is responsible for stormwater management, water quality, and aquatic habitat in the city. The Utility's program includes eight core services, including development review, technical assistance/code enforcement, public education and involvement, environmental planning and policy development, capital facilities planning, and monitoring, research and evaluation.

Portions of Woodard and Woodland Creek watershed are located within the city Of Olympia's jurisdiction and it's Urban Growth Area (UGA). Approximately 1,246 ac (28 percent) of Woodard basin are in the city limits, and 884 ac (18 percent) are in the UGA. Approximately 155 ac (0.8 percent) in Woodland basin are in the city, and 29 ac (0.2 percent) are in the UGA.

The city of Olympia (with Thurston County) monitors the ambient water quality and benthic macroinvertebrates in each of its streams. Water quality data are available online, [www.geodata.org/swater/](http://www.geodata.org/swater/), and macroinvertebrate data are published in the Stream Team newsletter. The city of Olympia regularly works with Thurston County on water quality issues throughout the city. The city also actively investigates pollutant sources entering streams and stormwater through their Illicit Discharge Detection and Elimination Program and conducts outreach to businesses and residents.

### ***Environmental Protection Agency (EPA)***

EPA is responsible for seeing that the federal Clean Water Act is implemented. EPA must approve TMDL submittal reports. They also provide water quality-related grant funding.

### ***Henderson Inlet Shellfish Protection District citizen advisory group***

In December 2001, the Board of Thurston County Commissioners created shellfish protection districts for Henderson Inlet and the Nisqually Reach, in response to downgrades in shellfish harvest status. The following spring, the commissioners appointed a stakeholder group for each shellfish protection district. The groups developed recommendations for restoring water quality in Henderson Inlet and Nisqually Reach. Recommendations, submitted to the county commissioners in 2003, included improvements in management of on-site septic systems, stormwater management, agricultural practices, land use, and wildlife.

As a result of the recommendations of the Henderson and Nisqually Shellfish Protection District stakeholders groups, the two groups were combined and tasked with developing an Implementation Work Plan. That plan is available at <http://www.co.thurston.wa.us/shellfish/>

In December 2003, the combined shellfish protection district stakeholder group became the core members of a larger citizen advisory committee to help develop a risk-based operation and maintenance program for on-site septic systems in the Henderson Watershed. The program is in response to degrading water quality in Henderson Inlet and a Henderson DNA-typing study showing human waste is contributing to the problem. In the fall of 2005, the Thurston County Board of Health passed the Septic System Operation and Maintenance Proposal for Henderson Inlet Watershed.

The group continues to meet and oversee implementation of their work plan and issues affecting bacteria in Henderson Inlet. Their work, along with the *Henderson Watershed Total Maximum Daily Load Study*, will provide the foundation of the detailed cleanup plan for Henderson Inlet.

### ***Natural Resources Conservation Service (NRCS)***

The NRCS works in partnership with Pierce and Thurston Conservation Districts to improve water quality and conservation. Resources are targeted to address water quality priorities identified through local processes including watershed planning, Department of Health surveys, and TMDLs. The NRCS administers all of the programs in the 2002 Farm Bill, including:

- Conservation of Private Grazing Land Initiative
- Conservation Reserve Program
- Conservation Security Program
- Conservation Technical Assistance
- Environmental Quality Incentives Program
- Emergency Watershed Protection Program
- Farm and Ranch Lands Protection Program
- Grassland Reserve Program
- Plant Material Program
- Resource Conservation and Development Program
- Snow Survey and Water Supply Forecasts Program

- Soil Survey Programs
- Technical Service Providers
- Wetlands Reserve Program
- Wildlife Habitat Incentives Program

These programs are available to landowners in both Pierce and Thurston counties. Several of the programs provide cost-share incentives to landowners who commit to implementing certain conservation practices. For more information on Farm Bill programs, go to

<http://www.wa.nrcs.usda.gov/programs/index.html>

In addition to these programmatic resources, the NRCS provides staff time and technical expertise to support restoration efforts.

### ***Puget Sound Restoration Fund***

Founded in 1997, Puget Sound Restoration Fund (PSRF) is a nonprofit organization dedicated exclusively to achieving on-the-ground restoration of habitat and native species in Puget Sound. As a project-oriented, non-activist organization, PSRF has pioneered new approaches to the restoration of prime shellfish growing areas, launched regional efforts to restore marine species of historic and ecological significance and collaborated with diverse tribal, government, and private partners to restore local places that support real resources.

PSRF co-manages a community shellfish farm on Henderson Inlet in partnership with the Pacific Coast Shellfish Growers Association on property owned by Washington State University. The farm serves as a marine education facility, hosting hundreds of school children for shoreline tours every year, as well as providing a hands-on connection between citizens and shellfish resources during community harvest events. It also provides a focal point for environmental education related to pet waste and other sources of bacterial contamination.

In 2003, Governor Locke honored Geoff Menzies, manager of PSRF's Drayton Harbor Community Oyster Farm, and Betsy Peabody, executive director of PSRF, as "local heroes" for their efforts in restoring Puget Sound shellfish growing areas. In August 2005 PSRF's native oyster restoration project was one of 30 projects from around the nation showcased at the White House Conference on Cooperative Conservation as premier examples of cooperative conservation. In October 2005, the state Department of Ecology awarded PSRF with an Environmental Excellence Award – the state's highest for environmental stewardship - for efforts to connect people's actions to clean water in Henderson Inlet and elsewhere in Puget Sound.

### ***Puget Sound Water Quality Action Team***

The Puget Sound Water Quality Action Team, under authority of Chapter 90.71 RCW, works with governments and organizations across the region to carry out the Puget Sound Water Quality Management Plan. Under different parts of the plan, agencies and governments provide technical and financial assistance to control pollution from septic systems, farm animal wastes

and stormwater runoff. Support staff of the Action Team assist directly with programs to protect and restore shellfish harvesting in Puget Sound. The Action Team also administers grant funds for public involvement and education projects.

### ***Thurston Conservation District***

Thurston Conservation District under authority of Ch. 89.08 RCW, Conservation Districts, provides education and technical assistance to residents, develops conservation plans for farms, and assists with design and installation of best management practices. When developing conservation plans, the district uses guidance and specifications from the U.S. Natural Resources Conservation Service. Farmers receiving a Notice of Correction from Ecology will normally be referred to Thurston Conservation District for assistance.

Thurston Conservation District is funded by a county-wide district assessment, in accordance with Chapter 89.08.400 RCW. The district assessment excludes properties within the city limits of Yelm, Tenino, and Rainier, as those cities were formed before 1948 and chose to be excluded, per the RCW. Currently, 28 percent of the District's tax assessment is dedicated to project work in the Shellfish Protection District. The district regularly receives funding from the Conservation Commission, and grants funding from Ecology, the Salmon Recovery Funding Board, and others.

In addition to conservation planning, technical and cost-share assistance to landowners, the Conservation District has a yearly native plant sale and provides a majority of the funding for South Sound GREEN, a student-based volunteer monitoring and education program.

They also coordinate the Shellfish Pledge Program, an incentive based program that is geared toward both urban and rural landowners.

### ***Thurston County***

Thurston County has maintained a county-wide ambient surface water monitoring program for over 15 years. The program tracks flow, macroinvertebrates, and ambient water quality. At any given time the program includes approximately 20 sites on major and priority streams and rivers, with site selection being somewhat adaptive based on issues, needs, and funding. In the north part of Thurston County the program is funded by the stormwater utility.

The Thurston County Storm and Surface Water Utility was created in 1985 to help curb flooding and pollution problems caused by stormwater runoff. It is funded by fees from residents who own property in unincorporated Thurston County within the utility rate boundary. The utility reduces pollution and flooding damage through a combination of capital facilities, public-education, facility operations and maintenance, and drainage and erosion control standards for new development. Some areas of Thurston County will be covered under the Phase II NPDES stormwater permit, expected to be final by early 2006.

During 1999-2000, Thurston County used Ecology grant funds to conduct a microbial source tracking study to discern pollutant source types in Henderson Inlet and Woodland Creek. The



results of this study have helped the county target water quality work and will help in the ongoing cleanup effort. The study is available online at

<http://www.co.thurston.wa.us/shellfish/publicationsmedia.htm>

The county also participated in water quality monitoring as part of the Henderson TMDL water quality study.

The county regulates land use in unincorporated areas through a Critical Areas Ordinance (Ch. 18E.60.050), in accordance with Washington State's Growth Management Act, Ch. 36.70A. They are currently updating the ordinance. The update proposes increased buffer requirements along all classes of streams, as well along marine shorelines.

The county has created a Low Impact Development Steering Committee to investigate the feasibility of developing Low Impact Development regulations and standards. The committee plans to take a proposed action plan to the Board of County Commissioners in 2007.

Minimum on-site requirements are established by Washington Department of Health (DOH) in Chapter 246-272A WAC, and the county has established further standards under Article IV of the Thurston County Sanitary Code. County compliance staff deals with on-site failures, usually in response to complaints. In addition, the health department conducts on-site investigations. These investigations are usually grant-funded, and conducted in response to known problems with specific geographic focus. Thurston County maintains a loan fund for repair of failing or failed on-site septic systems, or to correct a failing or failed on-site system with connection to municipal sewer service where available. They will administer the Septic System Operations and Maintenance Program.

Article VI, 4.2, of Thurston County Sanitary Code, requires preventing domestic animal waste from being washed into surface water, prohibits exceeding agronomic rates when applying manure, sludge and crop residues, and prohibits intentional dumping of pet waste that will affect surface or storm water. An update of this ordinance, assuring enforceability, is planned for 2006.

### ***Washington Department of Ecology (Ecology)***

Washington State Department of Ecology has responsibility under the federal Clean Water Act to establish water quality standards, coordinate water cleanup projects (TMDLs), and enforce water quality regulations under the Water Pollution Control Act (Chapter 90.48 RCW). In addition to this regulatory role, Ecology gives grants and loans to local governments, tribes, conservation districts, and citizens groups for water quality projects. Projects that put into action water cleanup plans for TMDLs are a high priority for funding.

For non-dairy agricultural problems, if Ecology confirms that poor farm management practices are likely to be polluting surface waters, farmers are typically referred to conservation districts for technical assistance. If necessary, Ecology can require specific actions under Ch. 90.48 RCW, such as implementation of an approved farm plan, to correct the problem.

Ecology is currently developing stormwater municipal NPDES Phase I and II permits, including a permit for the Department of Transportation. These permits are expected to be final by late 2006.

#### ***Washington Department of Health (DOH)***

The Department of Health (DOH), under authority of Ch. 43.70 RCW, monitors marine water quality in commercial shellfish growing areas of the state, including Henderson Inlet. DOH has restricted commercial shellfish harvest in areas of the Reach due to fecal coliform levels in excess of public health-based water quality standards. Currently one sampling station is under restricted status. DOH continues to monitor water quality in the Reach at least six times per year.

#### ***Washington State Department of Transportation (WSDOT)***

WSDOT is responsible for managing stormwater from state highways, including Interstate 5 stormwater facilities and the outfall that discharges to Woodland Creek at river mile 3.1.

#### ***Washington State University (WSU) Extension***

WSU water quality programs in Thurston and Mason counties work proactively to better protect water resources. Primary program efforts include:

- The WSU Water Resources Real Estate Professional Education program provides information to associates, brokers, developers, and appraisers about water resource issues. The purpose is to assist these real estate professionals and their clients to make sound decisions regarding modifying the landscape. Instruction by local experts covers the issues and related best available science, as well as regulatory and non-regulatory ways water resources can be protected. Courses provide clock hours towards professional license re-certification. A total of 220 participants have been involved during the past year.
- The Native Plant Salvage Project is directly affiliated with WSU Extension, however funding is provided by local jurisdictions, grants, state, and federal agencies. The program educates residents and developers about retaining vegetation to reduce stormwater, increase groundwater recharge, provide filtration and reduce pesticide use. The program has involved over 1200 individuals in its educational programs during the past year and has 250 volunteers.
- On a bi-monthly basis WSU convenes the Environmental Education Technical Advisory Committee, which serves to coordinate and foster collaborative efforts for the educational activities of the non-profits, jurisdictions, and agencies serving the region.

## **What is the Schedule for Achieving Water Quality Standards?**

The goal is to meet water quality standards for bacteria by the end of 2015. Due to Thurston's County's On-site sewage System Operation and Maintenance Program and the stormwater efforts of the Cities of Lacey and Olympia, Thurston County, and the Washington Department of Transportation, approximately 75 percent of that reduction is anticipated by the end of 2011.

## Reasonable Assurances

TMDLs must show “reasonable assurance” that sources will be reduced to their allocated amount. Outreach, technical and financial assistance, permit administration, and enforcement will all be used to ensure that the goals of this water clean up plan are met.

The goal of the Henderson Inlet Watershed Water Quality Improvement Report is for the waters of the basin to meet the state’s water quality standards. There is considerable interest and local involvement toward resolving the water quality problems in this watershed. Ecology believes that the following activities are already supporting this TMDL by addressing some of the key issues, and add to the assurance that fecal coliform bacteria in the Henderson Inlet watershed will meet conditions provided by state water quality standards. These activities also support reductions in nutrient levels for Woodland Creek, and will help improve dissolved oxygen levels. This assumes that the activities described below are continued and maintained:

- In the fall of 2005, the Thurston County Board of Health took an essential step for reducing pollution from septic systems by adopting the Henderson Inlet Watershed Septic System Operations and Maintenance Program. This program assures maintenance of septic systems in this watershed.
- Thurston County, working with the city of Lacey, currently has a grant through Ecology to do a more in-depth analysis of sources of pollution to Woodland Creek, including groundwater. They will pull together, in one comprehensive package, existing information on current conditions, an estimated “budget” of pollutant loading from each of the major sources, and projections of pollution load increases or reductions assuming various infrastructure improvement and pollution control scenarios. This package will be used to support implementation of the most feasible and effective water quality improvement options, which may include facility designs, pursuit of funding, and/or policy or regulation changes.
- The city of Olympia will monitor fecal coliform levels from stormwater discharging from the Taylor Wetlands stormwater treatment facility just south of the Interstate 5.
- The city of Lacey is currently designing a regional stormwater treatment facility for College Ditch, the last untreated stormwater discharge in the city that flows directly to Woodland Creek. Construction is expected to begin in 2006.
- The city of Lacey has conducted ongoing work to protect and restore the riparian buffer of Woodland Creek. They are planting stream banks on public land, and have grants available to help landowners who want to improve their own stream banks.
- Washington Department of Transportation (WSDOT), Thurston County, and the Cities of Lacey and Olympia are covered by stormwater municipal NPDES (National Pollution Discharge Elimination System) permits. Stormwater discharges within the permitted area, roughly half of Henderson watershed, are subject to permit requirements.

- Henderson Inlet Shellfish Protection District citizen advisory group continues to meet and oversee implementation of their work plan.
- There are a number of on-going and effective outreach efforts that support this cleanup effort. Some highlights are:
  - ~ Both the city of Lacey and Thurston County have active Stream Teams, involving citizens in benthic invertebrate monitoring and riparian restoration projects.
  - ~ South Sound GREEN is actively involving students in water quality monitoring and education.
  - ~ Thurston County regularly conducts septic system education as part of its operations and maintenance program.
  - ~ The county and Conservation District are working together on a watershed pledge project.
  - ~ The city of Olympia has, at the request of residents, installed Stop and Scoop stations on Woodard Creek, to include signs, pet waste collection baggies, and an information rack. Thurston County has installed pet waste stations at two community parks along Woodland Creek, plus signs at seven homeowner green spaces on Henderson Inlet, with pet waste stations in all but one. The city of Lacey has installed pet waste stations in all public parks in Henderson Inlet watershed, plus signs and pet waste stations at seven residential neighborhoods in the watershed.
  - ~ The Pacific Shellfish Fund also conducts outreach on pet waste, as well as general water quality education at their Henderson Inlet community shellfish farm.
  - ~ On a bi-monthly basis, WSU convenes the Environmental Education Technical Advisory Committee, which serves to coordinate and foster collaborative efforts for the educational activities of the non-profits, jurisdictions and agencies serving the region.

While Ecology is authorized under Chapter 90.48 RCW to impose strict requirements or issue enforcement actions to achieve compliance with state water quality standards, it is the goal of all participants in the Henderson Inlet watershed water quality improvement process to achieve clean water through voluntary control actions.

# **Adaptive Management**

The technical advisory group expects to achieve TMDL reductions by 2015. The Detailed Implementation Plan will identify interim targets. These targets will be described in terms of concentrations and/or loads, as well as in terms of implemented cleanup actions. Partners will work together to monitor progress towards these goals, evaluate successes, obstacles, and changing needs, and make adjustments to the cleanup strategy as needed. Ecology will coordinate the adaptive management process.

Ultimately, it is Ecology's responsibility to assure that cleanup is being actively pursued and water quality standards are achieved.

# Summary of Public Involvement Methods

Ecology and partners have worked together on this TMDL from designing the sampling plan, to field work, to developing this Water Quality Improvement Report. Ecology has briefed the Shellfish Protection District citizens' advisory group of progress and findings. Briefings on the TMDL study have been provided at public meetings sponsored by the Shellfish Protection District Stakeholder Groups.

In addition to continuing to work with partners to finalize this report, Ecology will conduct a public review of the draft report including public notice. During the public comment period, Ecology will offer to meet with interested groups, post the draft report and supporting documentation on Ecology's TMDL website, and place documents in local libraries for public review. Ecology will produce a Response to Comments subsequent to the public comment period, to document comments received and how they were addressed.

# Potential Funding Sources

The programs of each of the involved organizations have some base funding that will contribute to implementing and monitoring costs. But base funding is not adequate to meet the needs. The programs listed below, and possible others, are potential sources of additional funding:

- Centennial Clean Water Fund, Washington State Water Pollution Control Revolving Fund and Federal Clean Water Act Section 319 Funds, administered by Ecology
- Environmental Quality Incentives Program, Conservation Reserve Enhancement Program, and Wildlife Habitat Incentives Program cost-share money from the U.S. Dept. of Agriculture's Natural Resources Conservation Service
- Public Involvement and Education funding from the Puget Sound Action Team
- Salmon Recovery Funding Board grants and Washington Wildlife and Recreation Program grants from the Washington Interagency Committee for Outdoor Recreation
- Thurston County's low interest loan program for on-site septic system repair and replacement
- U.S. Dept. of Agriculture Rural Development, Home Repair Loan and Grant Programs (as authorized by Section 504 of the Housing Act of 1949, 7 CFR Part 3550; contact U.S.D.A. Service Center of Puyallup, Washington, (253) 845-0553).
- Shellfish District Cost Share Program for agricultural best management practices, administered by Thurston Conservation District
- Shellfish District Cost Share Program for inspection, maintenance, and minor repairs of qualifying on-site septic systems, administered by Thurston County



## Next Steps

Once the TMDL has been approved by EPA, Ecology, the technical advisory group (which includes the groups described in the *Who needs to be involved?* section above), and other local interests will develop a detailed plan for improving water quality, choosing the combination of possible solutions they think will be most effective in this watershed. The plan, called a Water Quality Implementation Plan, will describe cleanup actions needed, and their priority; who is responsible for those actions; how will the technical advisory group figure out whether actions worked; what if it doesn't work; and potential funding sources. It usually takes about a year to develop a Water Quality Implementation Plan.

## References

Please see the Reference section in Volume 1, *Henderson Inlet Watershed Fecal Coliform Bacteria, Dissolved Oxygen, pH, and Temperature Total Maximum Daily Load Study*.

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# Appendices



## Appendix A. Glossary and Acronyms

**303(d) list:** Section 303(d) of the federal Clean Water Act requires Washington State periodically to prepare a list of all surface waters in the state for which beneficial uses of the water – such as for drinking, recreation, aquatic habitat, and industrial use – are impaired by pollutants. These are water quality limited estuaries, lakes, and streams that fall short of state surface water quality standards, and are not expected to improve within the next two years.

**Best Management Practices (BMPs):** Physical, structural, and/or operational practices that, when used singularly or in combination, prevent or reduce pollutant discharges.

**Clean Water Act (CWA):** Federal Act passed in 1972 that contains provisions to restore and maintain the quality of the nation's waters. Section 303(d) of the CWA establishes the TMDL program.

**Fecal Coliform (FC):** That portion of the coliform group of bacteria which is present in intestinal tracts and feces of warm-blooded animals as detected by the product of acid or gas from lactose in a suitable culture medium within twenty-four hours at 44.5 plus or minus 0.2 degrees Celsius. FC are “indicator” organisms that suggest the possible presence of disease-causing organisms. Concentrations are measured in colony forming units per 100 milliliters of water (cfu/100mL).

**Load Allocation (LA):** The portion of a receiving waters' loading capacity attributed to one or more of its existing or future sources of nonpoint pollution or to natural background sources.

**Loading Capacity:** The greatest amount of a substance that a water body can receive and still meet water quality standards.

**National Pollutant Discharge Elimination System (NPDES):** National program for issuing, modifying, revoking and reissuing, terminating, monitoring and enforcing permits, and imposing and enforcing pretreatment requirements under the Clean Water Act. The NPDES program regulates discharges from wastewater treatment plants, large factories, and other facilities that use, process, and discharge water back into lakes, streams, rivers, bays, and oceans.

**Nonpoint Source:** Pollution that enters any waters of the state from any dispersed land-based or water-based activities, including but not limited to atmospheric deposition, surface water runoff from agricultural lands, urban areas, or forest lands, subsurface or underground sources, or discharges from boats or marine vessels not otherwise regulated under the National Pollutant Discharge Elimination System Program. Generally, any unconfined and diffuse source of contamination. Legally, any source of water pollution that does not meet the legal definition of “point source” in section 502(14) of the Clean Water Act.

**Point Source:** Sources of pollution that discharge at a specific location from pipes, outfalls, and conveyance channels to a surface water. Examples of point source discharges include municipal wastewater treatment plants, municipal stormwater systems, industrial waste treatment facilities, and construction sites that clear more than 5 acres of land.

**Pollution:** Such contamination, or other alteration of the physical, chemical, or biological properties, of any waters of the state, including change in temperature, taste, color, turbidity, or odor of the waters, or such discharge of any liquid, gaseous, solid, radioactive, or other substance into any waters of the state as will or is likely to create a nuisance or render such waters harmful, detrimental, or injurious to the public health, safety, or welfare, or to domestic, commercial, industrial, agricultural, recreational, or other legitimate beneficial uses, or to livestock, wild animals, birds, fish, or other aquatic life.

**Stormwater:** The portion of precipitation that does not naturally percolate into the ground or evaporate but instead runs off roads, pavement, and roofs during rainfall or snow melt. Stormwater can also come from hard or saturated grass surfaces such as lawns, pastures, playfields, and from gravel roads and parking lots.

**Total Maximum Daily Load (TMDL):** A distribution of a substance in a water body designed to protect it from exceeding water quality standards. A TMDL is equal to the sum of all of the following: 1) individual wasteload allocations (WLAs) for point sources, 2) the load allocations (LAs) for nonpoint sources, 3) the contribution of natural sources, and 4) a Margin of Safety to allow for uncertainty in the wasteload determination. A reserve for future growth is also generally provided.

**Wasteload Allocation (WLA):** The portion of a receiving water's loading capacity allocated to existing or future point sources of pollution. WLAs constitutes one type of water quality-based effluent limitation.

**Watershed:** A drainage area or basin in which all land and water areas drain or flow toward a central collector such as a stream, river, or lake at a lower elevation.

## Appendix B. Henderson Inlet and tributaries that do not meet water quality standards (on the 303(d) list of impaired water bodies).

Water Body	Parameter	Lat/Long or Township/Range/Section	2004 303(d) list ID	1998 303(d) list ID	1996 303(d) list ID
Marine Water					
Henderson Inlet	FC	47.115, 122.835	39766	390KRD	WA-13-0010
	FC	47.105, 122.825	39756	390KRD	WA-13-0010
	FC	47.115, 122.825	39755	390KRD	WA-13-0010
	FC	47.135, 122.835	39763	390KRD	WA-13-0010
	FC	47.125, 122.835	39767	390KRD	WA-13-0010
	FC	47.125, 122.825	39770	390KRD	WA-13-0010
	DO	47.155, 122.825	*	390KRD	WA-13-0010
Freshwater					
Dobbs Creek	FC	19N 01W 28	40612	UNK000	WA-13-1400
	pH	19N 01W 28	40613	UNK000	WA-13-1400
Sleepy Creek	FC	19N 01W 18	40614	UNK000	WA-13-1700
	DO	19N 01W 18	40616	UNK000	WA-13-1700
	pH	19N 01W 18	40615	UNK000	WA-13-1700
Woodard Creek	FC	19N 01W 19	3772	MJ83ZH	WA-13-1600
	DO	19N 01W 19	3771	MJ83ZH	WA-13-1600
	pH	19N 01W 19	40587	MJ83ZH	WA-13-1600
Woodland Creek	FC	18N 01W 16	6657	JH31LN	WA-13-1500
	DO	18N 01W 16	3774	JH31LN	WA-13-1500
	Temp	18N 01W 33	36180	JH31LN	WA-13-1500
	Temp	18N 01W 15	36184	JH31LN	WA-13-1500
	Temp	18N 01W 22	36185	JH31LN	WA-13-1500
	Temp	18N 01W 16	3773	JH31LN	WA-13-1500
	Temp	18N 01W 04	36181	JH31LN	WA-13-1500
	Temp	18N 01W 09	36182	JH31LN	WA-13-1500
	Temp	18N 01W 10	36183	JH31LN	WA-13-1500
College Creek	FC	18N 01W 16	*	**	**
Eagle Creek	FC	18N 01W 09	*	**	**
Palm Creek	FC	18N 01W 04	*	**	**
Fox Creek	FC	18N 01W 04	*	**	**
Jorgenson Creek	FC	18N 01W 04	*	**	**
	FC	18N 01W 05	*	**	**
Quail Creek	FC	19N 01W 32	*	**	**
	FC	19N 01W 33	*	**	**
Meyer (Snug) Creek	FC, pH	19N 01W 20	*	**	**
Goose Creek	FC	19N 01W 32	*	**	**

\* does not meet standards, but not on 2004 303(d) list.

\*\* does not meet standards, but not on either the 1998 or 1996 303(d) lists.

FC – Fecal coliform bacteria

DO – Dissolved oxygen

Temp – Temperature

